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MINERALS FOR AMERICA



**U.S. DEPARTMENT OF THE
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BUREAU OF LAND MANAGEMENT**

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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MINERALS FOR AMERICA

By Mark Guidry
Public Affairs Specialist

Spring 1974. The Arab oil embargo shocks a nation long accustomed to an uninterrupted flow of cheap petroleum. The cutoff of oil from the Middle East dramatically underscores America's growing dependence on foreign sources of energy and strategic minerals. As Americans grumble impatiently while sitting in mile-long lines at neighborhood service stations, they are troubled and bewildered. How can this happen to the richest nation on earth? A nation that once led the world in energy and mineral exploration and development?

The answers don't come easy, but from the smoldering ashes of uncertainty arises a grim determination. *Never again -- will we be caught off guard. Never again -- will we place ourselves at the mercy of foreign nations for the energy and mineral resources so vital to our economic well-being. Never again -- will we jeopardize our economic health or our national defense by reliance on uncertain mineral sources.*

For this is not a story of defeat. It is not a story of how we were brought to the brink of disaster. Rather, it is the story of how America responded to the challenge, and how that challenge was met. More specifically, it is the story of how the resources from the public lands are helping to meet the nation's needs for energy and minerals.

From its earliest beginnings, the United States has been blessed with abundant resources. Our forefathers were attracted to this new land by the abundance of fertile lands, great forests, and space for the huddled masses of the old world yearning to "breathe free."

In the 19th century, minerals from

beneath the earth's surface fueled America's leadership in the worldwide industrial revolution. As our technology grew, so did our need for minerals.

Coal from the hills of Appalachia powered our burgeoning factories and fed the "iron horses" that opened the way West. On January 11, 1901, just 11 days into the 20th century, the first oil "gusher," from a well drilled deep under the East Texas earth, near a sleepy sawmill town called Beaumont, ushered in the modern transportation age. Other discoveries enabled America to grow, to work, and to assume its modern day place in the sun.

For a time, supply kept pace with demand. But population growth and advances in our standard of living have upset that balance. Fortunately, the public lands contain vast amounts of vital energy and mineral resources -- enough to meet our needs now and for the future.

Some 300 million acres of these lands are managed by the Bureau of Land Management (BLM). These are the lands remaining after homesteading, grants to States and railroads and all the other land disposal programs carried out by BLM and its predecessor agencies. Until a few years ago, these were the "lands nobody wanted." Today, we realize that, in addition to their surface resource and open space values, these lands, with their important mineral resources, constitute an important key to the future.

Another 440 million acres are managed by the Forest Service, the Defense Department or one of several other Federal agencies. Management of the mineral resources on these lands is also the responsibility

of BLM. Altogether the Bureau manages the subsurface minerals on some 740 million acres of Federal land.

Traditionally, these minerals have been made available for development under three separate systems.

Gold, silver and certain other "hardrock" minerals may be "located" under the mining laws. Miners typically obtain prospecting permits giving them exclusive rights to look for these minerals in specific areas, and to stake mining claims enabling them to extract any minerals found in paying quantities.

Oil and gas, phosphate, sodium, potassium and certain other minerals are "leasable" under the mineral leasing laws. Leases are issued on a competitive basis in geologic structures where such minerals are known to exist. Outside known structures, leases may be issued non-competitively.

Common variety minerals, such as sand, gravel or clay are sold to applicants at rates representing fair market value.

It is estimated that 40 percent of the nation's coal, 80 percent of its oil shale, and large deposits of oil, natural gas and uranium ore, tar sands and geothermal energy are found on the public lands managed by BLM.

The gold and silver that lured Americans westward in the days of the forty-niner now share the spotlight with less glamorous but equally

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Geothermal steam is harnessed to produce electricity, hot water and direct heating of homes and offices.

important minerals. Beryllium, used in making copper alloys, is mined in several states, and molybdenite, used in steel and iron alloys, is plentiful in Colorado. Idaho produces large amounts of antimony, used both in alloy production and in medicines. Idaho is also the world's largest producer of phosphate. California and New Mexico boast important deposits of potash, a principal ingredient in fertilizers.

The world's largest deposits of alunite, an ore which can be used to make aluminum, are believed to exist on Federal lands in Colorado and Utah. Development of this deposit could greatly reduce our dependence on bauxite, from which most of our aluminum is currently produced. About 95 percent of the bauxite now used in manufacturing aluminum comes from foreign sources, on which we may not be able to rely in the event of a national emergency.

To ensure orderly development of our mineral heritage, BLM recently entered a new era. While it has long been a multiple-use agency, the Bureau traditionally focused more attention on the management of forest, range and other surface resources. Now, the non-renewable resources that lie beneath the surface will receive their fair share of attention.

Over the years large blocks of land were withdrawn or otherwise put "off limits" to mining and mineral leasing. These areas were dedicated to other uses thought to be incom-

patible with mineral development. Many such withdrawals are valid, but others have recently been found to be unnecessary. Some areas, for example, were withdrawn from mineral activity decades ago so that the sites could be flooded by reclamation dam projects -- which were never built. Meanwhile, the protective

withdrawals remained in effect until the current withdrawal review program.

Other roadblocks to effective minerals management stemmed from a lack of expertise within the Bureau, from outmoded regulations that were burdensome, counter-productive and unnecessary, and from lack of emphasis.

MAKING LANDS AVAILABLE TO MINERALS DEVELOPMENT

Early in 1981, BLM began a systematic review of all areas that had been removed from mineral leasing and development activity. The object was to determine which withdrawals are still necessary to protect other resource values, such as scenic areas, wild rivers and wilderness areas, and to revoke those withdrawals found to be unnecessary.

To date, withdrawals have been revoked that return over seven million of these acres to full multiple use, including mineral leasing or mining operations.

Other withdrawals will be revoked when it is demonstrated that mineral development is not incompatible with the purposes for which the withdrawals were made.

BUREAU OF LAND MANAGEMENT MINERAL RESOURCES POLICY

The following principles will guide BLM in managing mineral resources on public land.

- Except for Congressional withdrawals, public lands shall remain open and available for mineral exploration and development unless withdrawal or other administrative action is clearly justified in the national interest.
- BLM actively encourages and facilitates the development by private industry of public land mineral resources in a manner that satisfies national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation practices.
- BLM will process mineral applications, permits, leases, and other use authorizations in a timely and efficient manner.
- BLM's land use plans and multiple use management decisions will recognize that mineral exploration and development can occur concurrently or sequentially with other resource uses. The Bureau further recognizes that land use planning is a dynamic process and decisions will be updated as new data are evaluated.
- Land use plans will reflect geology, energy, and mineral values on public lands through more effective mineral resource data assessment.
- The Bureau will maintain effective professional, technical, and managerial personnel knowledgeable in minerals exploration and development.

The Bureau also ended a leasing moratorium on lands acquired for military reservations, resulting in the immediate opening of some six million acres to leasing.

In 1980, the National Petroleum Reserve (NPRA) in Alaska was opened to oil and gas leasing. Two competitive sales were held in this area in 1982, and additional sales are planned over the next five years. Outside the NPRA, 3.2 million acres in Alaska were opened to non-competitive leasing in 1981 and 1982, and approximately 24 million more acres are being studied for possible opening by 1985.

CUTTING RED TAPE

Streamlining of regulations has also helped to promote mineral leasing and mining activity. A few years ago, the Bureau ordered a review of all regulations, with the view of eliminating those that were burdensome or unnecessary. Regulations dealing with oil, gas and geothermal leasing were substantially rewritten, as were those covering recordation of mining claims. New coal leasing regulations were adopted in 1982, leading to a resurgence in leasing of this valuable commodity. All together, rewriting of the regulations has cut the volume of printed rules by 17 percent, and made the remaining regulations easier to understand and easier to comply with.



Cattle graze on western public lands that have been reclaimed after coal has been mined.

"It is the continuing policy of the Federal Government to foster and encourage private enterprise in the development of a stable domestic minerals industry and the orderly and economic development of domestic mineral resources."

Robert F. Burford, Director
Bureau of Land Management

ORGANIZING FOR ACTION

Early in 1983, some 800 geologists, petroleum and mining engineers and other technical specialists from the Minerals Management Service (MMS) were transferred into BLM. This move places all of Interior's expertise within the same agency.

Prior to this merger, BLM was responsible only for issuing leases. It had to rely upon the MMS for pre-lease geologic studies to determine whether leases should be issued and under what terms. After leases were issued by BLM, the MMS again entered the picture to supervise operations and enforce lease terms and conditions. Integration of all these functions within BLM creates organizational efficiency and enables the Bureau to delegate more decision authority down to the field level where work is performed. The needs of the minerals industry and the public concerned with mineral activity can now be met more effectively. The reorganization also enables BLM

to do a more effective job of planning its multiple-use programs and activities.

A POLICY FOR THE FUTURE

An important incentive to orderly minerals exploration and development came when BLM Director Robert F. Burford unveiled the Bureau of Land Management Mineral Resources Policy, which commits the Federal Government to foster and encourage private enterprise in the development of a stable domestic minerals industry and the orderly and economic development of domestic resources. The policy reflects provisions of three important acts of Congress, and fulfills a pledge made by President Reagan in his April 1982 Minerals Report to the Congress.

MAKING PROGRESS

While the public lands have always been a source of energy and mineral resources, these recent initiatives are making them even more productive.

Five years ago, only 101 million acres of Federal lands were under lease for oil and gas exploration, while coal leases covered only 790,000 acres. Today, over 160 million acres are under lease for coal.

In that same period, the number of acres under lease for geothermal energy has increased from 1.7 million to 3.1 million acres, and exploration and development of other minerals is expected to increase as a result of streamlined leasing regulations, procedures and policies.

As the search for vital minerals continues, more discoveries will be made, forming a mosaic pattern that, when pieced together, constitutes a national inventory of energy and critical mineral resources. Even if these new discoveries are not developed immediately, knowing where these valuable resources are will add to the Nation's security and help us to make more informed decisions about how the public lands should be managed.

BLM PIPELINERS

By Linda Thurston and Arlan Kohl

Three engineers in the Alaska Office of Special Projects (OSP) have jobs that are unique within BLM: they monitor the activities surrounding the largest privately financed project in the world, the \$8 billion Trans-Alaska Pipeline System (TAPS). Jack McCoy, Gerhard Groeschel and Perry Francis are Authorized Officer's Field Representatives (AOFRs - pronounced Oh-fers) on the pipeline under the supervision of Jim Richardson, manager of the Alaska OSP.

Their job is to monitor operation and maintenance activities of the Alyeska Pipeline Service Company along the 800-mile-long crude oil line. The AOFRs are responsible for the sections of the pipeline that cross about 500 miles of BLM-administered lands. A right-of-way obtained from the Department of the Interior in 1973 allowed the pipeline to be built and operated across Federal lands. It was granted by an agreement between the Secretary of the Interior and the eight oil companies that own and operate the pipeline through their agent, Alyeska Pipeline Service Company.

As part of the original agreement, the eight owner companies reimburse the Bureau for AOFRs and other OSP staff who monitor company activities for environmental protection, pipeline integrity and public safety. The right-of-way grant requires the permittee to provide company vehicles, food, and lodging for the AOFRs and others taking part in the Government's surveillance effort since such services are few and far between along the pipeline route, particularly north of the Yukon River.

The largest oil field discovery in the United States is on Alaska's North Slope at Prudhoe Bay. It occurred in August 1968 in the midst of nationwide environmental awareness that resulted in passage of the National Environmental Policy Act (NEPA) in

1970. There were many concerns about building a pipeline through the last of America's unspoiled wilderness. Among these were impacts on caribou migrations, effects on the delicately balanced tundra and the underlying permafrost, and contamination from oil spills.

NEPA required that environmental impact statements be prepared for projects like the TAPS. The Trans-Alaska Pipeline Authorization Act set aside legal questions and directed the Secretary of the Interior to issue the necessary permits to allow construction of the pipeline to begin.

The right-of-way grant has stringent standards. The stipulations include

spills that might occur. Surveillance for compliance with these stipulations landed in the bailiwick of the AOFRs.

AOFR Duties

"The AOFRs inspect in the field 12 months a year under all kinds of hazardous circumstances," says Jim Richardson, their boss, "They may face minus 50 degree weather, snowstorms, and treacherous driving conditions on the pipeline haul road. They spend about four work days a week onsite somewhere along the 800-mile-length of the TAPS. And when the AOFRs are home, they are on 24-hour-emergency call."

BLM pipeliner Jack McCoy and other authorized officer's field representatives (AOFRs) patrol the Trans-Alaska Pipeline System to monitor activities from Prudhoe Bay to Valdez.



general, environmental, and technical requirements. The permittee is strictly liable for any damage to the environment or property, regardless of fault. Environmental stipulations include erosion control, provision for free and unrestricted passage of fish and big game animals, protection of antiquities, air and water quality, esthetics, restoration of disturbed areas, plus detection and clean up of any oil

Richardson also says that the farther north the men travel on the haul road, the more hazardous the driving conditions are. In summer, it's the dust that obscures the road, and in the winter it's the blowing snow. And all year long, the AOFRs have to watch for the big trucks that travel the haul road with supplies for the oil fields at Prudhoe Bay.



The 48-inch, insulated pipeline traverses rugged country to bring oil from the arctic.

Pipeline Construction

By spring of 1974, a massive mobilization effort was begun to build a hot-oil pipeline across Alaska. The logistics and design problems to be conquered were staggering. A one-half-mile long bridge across the Yukon River and 360 miles of highway were built to provide a surface transportation link between the oil field at Prudhoe Bay and the rest of Alaska. This highway was completed in 154 days and required 26 million cubic yards of gravel to build. Another 43 million cubic yards were used to construct the workpad from which the pipeline was built. This represents a cone of gravel 1,200 feet high and 2,400 feet in diameter.

Twenty-five construction camps were built to house the more than 21,000 men and women who built the pipeline, pump stations, and Valdez marine terminal. As a matter of fact, the project was of such dimension that it cost about \$25,000 per day at the peak of construction to supply the workers with soda pop!

From Sea to Shining Sea

The pipeline reaches from the well head at sea level on the Arctic Ocean to its terminus at sea level in Valdez on the Gulf of Alaska. It crosses climatic and physiographic zones that include the Arctic plains, Brooks Mountain Range, Yukon and Tanana River drainages, Alaska Mountain

Range, Copper River basin, Chugach Mountain Range, and coastal terrain on Prince William Sound. Annual snow fall ranges from about 40 inches on the North Slope to 970 inches at Thompson Pass near its southern terminus.

Nearly the entire route is underlain with continuous or discontinuous permafrost, perhaps the most challenging and complex design problem to overcome. The pipeline crosses 40 major rivers, some of them teeming with salmon, grayling or char. Wild animals

abound, including moose, caribou, black and grizzly bear, bison, fox, wolf, lynx, and many other smaller animals. Occasionally polar bear and musk ox have been sighted near the pipeline.

Superlatives Describe TAPS

There are many superlatives to describe the Trans-Alaska Pipeline System.

It is the first hot oil (145°F) pipeline to be built in an arctic region of the world.

It was the first pipeline to be built across thaw-unstable permafrost which dictated above-ground construction. About half of the length of the 48-inch-diameter pipeline is elevated above ground while the remainder is buried.

The pipeline has the most sophisticated and accurate leak alert system in operation.

Pipeline Capacities

At the Valdez terminus, 18 oil-holding tanks, each with a 500,000 barrel capacity, store the crude oil until it can be loaded aboard tanker ships. (One barrel of oil equals 42 gallons.) The tankers, ranging in capacity from about 200,000 barrels to 1.8 million barrels, transport the oil to refineries in the continental United States and the Virgin Islands.

The Prudhoe Bay and Kuparuk fields daily produce 1.5 and .1 million

Pump Station 4, located in the northern foothills of the Brooks Mountain Range, is accessible by the road the BLM pipeliners travel.





A moose passes beneath a section of above-ground pipeline. Animal crossing places are provided frequently along the pipeline.



The pipeline's route was selected after consideration of terrain, soil, and environmental factors.



The southern terminus of the Trans-Alaska Pipeline System is at Valdez, where tankers take on oil for ocean shipment.

barrels respectively. The pipeline currently operating with 10 pump stations delivers 1.6 million barrels per day. At a crude oil price of \$20 per barrel, for example, this means that about \$32 million worth of oil per day flows through the pipeline. The equivalent of a GS-11 government employee's annual salary in oil value passes a given point on the pipeline every 66 seconds. The State of Alaska derives about 90 percent of its revenues from oil production royalties.

AOFR Special Skills

Such a sophisticated and complicated pipeline system means that the BLM surveillance staff also must have special skills. The three AOFRs — Jack McCoy, Gerhard Groeschel, and Perry Francis — meet these qualifications.

Jack McCoy monitors the northern third of the pipeline from Prudhoe Bay to the Yukon River. He and his co-workers average about 600 miles a week driving on the work pad and the adjacent haul road in their Alyeska assigned vehicles.

Says McCoy, "The dust is the worst. Driving the haul road is hours of sheer boredom interspersed with a few seconds of stark terror when you meet a big truck. They don't pull over; you move over. It takes quick responses and driving skill to avoid getting hit by a truck or a rock or dropping off the road getting out of their way."

McCoy's 15 years of arctic engineering experience includes work for the U.S. Army Corps of Engineers and the

Cold Regions Research and Engineering Laboratory. He spent five summers on the Greenland's ice cap. He also supervised the digging of the permafrost tunnel near Fairbanks, Alaska, which has been studied and viewed by countless students, scientists, engineers, and tourists from around the world. McCoy also worked on the Minute Man Missile project in North Dakota and the currently proposed Alaska Natural Gas pipeline project.

Gerhard Groeschel, who monitors the southern section of the pipeline from Delta to Valdez, has had 17 years experience with the Corps of Engineers, seven of them in Alaska beginning in 1965. He worked on a variety of military projects in Alaska and the Snettisham hydroelectric dam project near Juneau. In 1969 he took a six-year assignment in Bitburg and Stuttgart, Germany, where he worked on Army and Air Force bases.

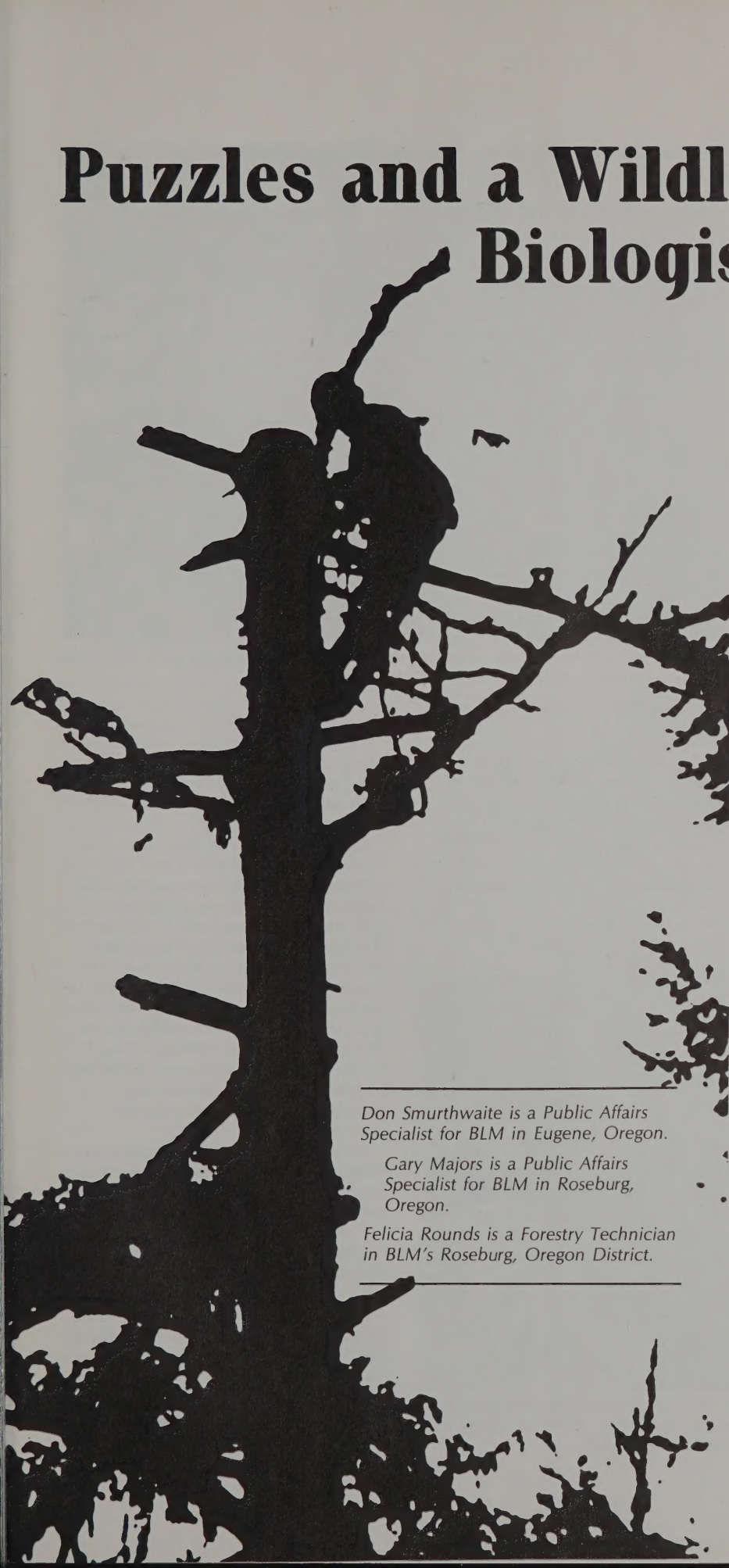
Gerhard also cut crystal in his uncle's factory in Germany as a young man, was a chicken farmer, and was a commercial fisherman during his college days in Washington and Alaska.

Perry Francis, the newest of the AOFRs, has served the past two years as an alternate AOFR. He recently replaced Herb Kittler who retired in April, 1983. Perry covers the central part of the pipeline from the Yukon River to Delta. His 27 years of engineering experience were with the Bureau of Indian Affairs, Bureau of Reclamation, and BLM.

Kittler was considered the "dean" of AOFRs with his 23 years of combined service in the Corps of Engineers and BLM. He spent nine years of continuous service as a field monitor starting with pipeline construction in 1974.

Arlan Kohl, project manager for TAPS and the person who has been with the project the longest, is justifiably proud of the AOFRs. He says, "They're a group of unusual individuals working on a project that is unique to BLM and the World. It takes special skills and technology. It also takes a lot of experience, and they've got it all."

Linda Thurston is a technical publications editor for the Alaska State Office, Public Affairs Staff. Arlan Kohl is the project manager for the Trans-Alaska Pipeline System in the Office of Special Projects, Alaska State Office.



Puzzles and a Wildlife Biologist's Bag of Tricks

By Don Smurthwaite, Gary
Majors, and Felicia Rounds

Deep in the forests of western Oregon, there are some puzzles that need to be solved. The puzzles involve people and jobs, esthetics, and the hard choices of how to accommodate competing resource uses.

One puzzle concerns the spotted owl, a tranquil, 18-inch, brown-flecked bird. Also involved is old-growth timber, generally Douglas-fir, 200 years of age and up.

The problem is this: both the spotted owl and the timber industry need old-growth timber. The bird needs it for a home, the timber industry for harvest. Spotted owls need lots of old growth for their habitat, and timber is needed from which to manufacture thousands of products.

Over thousands of years, the spotted owl has neatly adapted itself to old growth. The forest canopy protects it from harsh weather and from natural enemies. There are plenty of broken-topped but living trees in old growth, the kind of trees the spotted owls nest in. The food supply is plentiful.

It's a tough problem, but the beginnings of a solution to this and other wildlife dilemmas might be underway in the Bureau of Land Management's Roseburg, Oregon, District.

In the case of the spotted owl, Joe Witt, a BLM wildlife biologist, figured that the way to part of the answer might be found through the bird's stomach.

A large part of the spotted owl's diet consists of the northern flying squirrel, an animal that Witt hopes isn't as fussy about living exclusively

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Felicia Rounds is a Forestry Technician in BLM's Roseburg, Oregon District.



The spotted owl, a peaceful denizen of the Pacific Northwest, is finding itself caught in the middle of a controversy between environmental groups and the timber industry.



Only cull trees are used for the "create-a-snag" blasts. Funding problems have limited the experiment to one area in the Roseburg District so far.

in old growth. Witt reasons that if more of the flying squirrels could be lured into younger, "second-growth" stands of trees, the spotted owl might follow. "We need to maintain a spotted owl population," Witt said. "By increasing the supply of their prey base—the flying squirrel—in second growth stands, we may reduce the owl's dependence on its old-growth habitat."

Witt began a study to see just how willing the flying squirrel is to move into second growth. The bait? Artificial housing.

Witt had 45 wooden boxes, 17 inches tall, 11 inches wide and nine inches deep, attached to trees in one study area in the Roseburg District.

"In the East, nest boxes have been used for years as homes to birds. But there were always some gray squirrels that moved into the boxes, too," Witt said. What unexpectedly worked in the East might work in the West by purpose, he theorized. He also recalled some Forest Service nesting box installations that attracted flying squirrels as well as birds.

"But none of the studies were exclusively directed toward the flying squirrel," Witt said. "I decided to apply what was being used in the East to the situation out here."

The boxes were designed to mini-

mize the effects of the weather on the flying squirrel, and also to keep its other natural predators, primarily opossums and raccoons, out. The first boxes were set out in April 1981.

Not only does Witt hope to find out how well the flying squirrels like the nesting boxes, but also if they prefer walk-up apartments or pent-

houses. Some boxes were placed at the 10-foot level, while others were attached to the tree 50 feet up from the base.

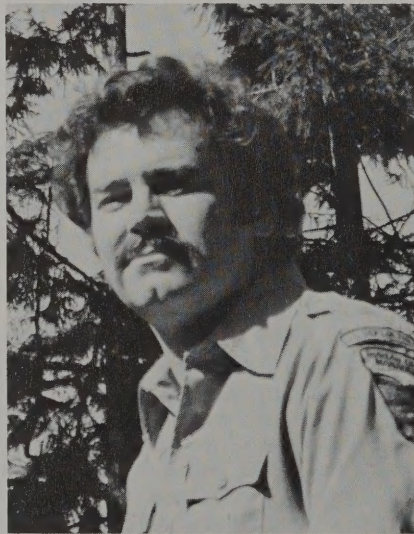
In the first phase of the study, live squirrels will be checked and the occupants tagged. Trapping will also help to estimate the population size and also provides a basis to compare the squirrels caught on the ground with those inhabiting the boxes. The second phase of the study will zero in on population counts in the second growth for a two-year period, while the final phase will monitor changes in the squirrels' population, densities and distribution in the second growth, after the nest boxes are installed.

Witt isn't expecting the squirrels to move right in, but hopes that within a year or so some of the animals will set up housekeeping.

"Theoretically, it all looks good on paper," Witt said cautiously, "but it is still too early to say which way it will go."

Joe Lint, another Roseburg District wildlife biologist who has worked on the project, points out that getting the flying squirrel into the second growth is not a panacea.

"The owls will always need old growth, but I believe that if we can get them into the second growth for



Joe Witt tries to locate the platforms near a second, taller tree to allow the ospreys a natural perching place.

more accelerated feeding, then it will take off some of the pressure on the old growth.

"We feel confident that if the boxes are there and everything else is right, the squirrels will use them," he said.

"We may look at the whole thing in five years and see that few boxes are being utilized," said Lint of the high-stakes study. Then we'll have only one conclusion—that the nesting box isn't part of the answer.

Both wildlife biologists are accustomed to talking in terms of the long run. Changing wildlife habits developed over eons isn't accomplished quickly. They also point out that the spotted owl is only one creature that will be affected by changes in old growth. Pileated woodpeckers, nuthatches and downy woodpeckers are but a few of the critters that make old growth their home.

Another creature with habitat problems is the osprey, a 22-inch long bird that flies from Central America to the Pacific Northwest each spring. In the Roseburg District, ospreys prefer nesting near a river in dead old-growth trees, usually Douglas-fir, called "snags." The trouble is, that after years of increasing cultivation along the Umpqua River, there aren't enough snags left for the ospreys.

It was Lint who suggested that topping trees along the river might help fill the nesting needs of the osprey.

"We have a fairly decent population of ospreys along the Umpqua. But as we plotted the nest sites along the river, there were some gaps," Lint explained. "We wanted to fill in those gaps where there weren't any suitable nesting sites."

Witt became intrigued by the idea of adding a platform to the topped trees for a nesting site. That approach has been used with good success for other osprey populations in lakes and reservoirs.

"I started doing some reading . . . then some more . . . and more," Witt said. "Then I talked with some people who have done this kind of thing before."

What Witt came up with was a four-by-four platform bolted onto selected Douglas-firs that were topped at a height of 125 to 150 feet. He added a wire mesh in the bottom of each platform to give greater stability for the nest. As another benefit to the birds, Witt also tried to locate

each platform near a second, taller tree that the ospreys could use for a perch.

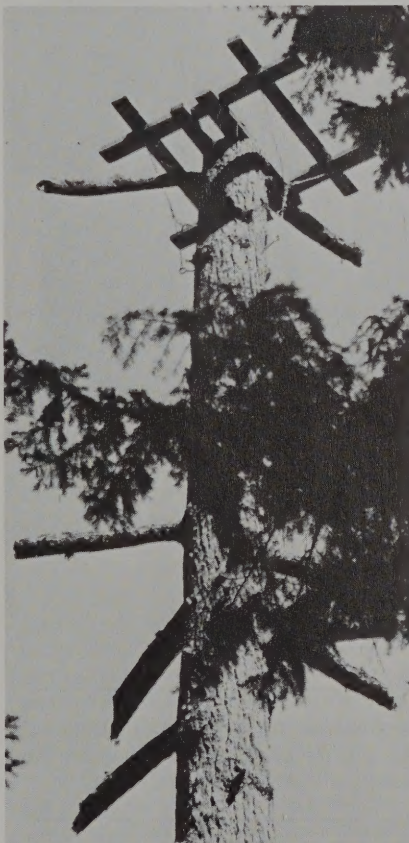
"Ospreys like to have a perching tree so they can look into their nest on the next tree over and view the river," Witt said.

Eleven of the osprey high rises have been placed, most of them within 100 feet of the river. Once again, neither Witt nor Lint are looking for miracles in the short run.

"We may not get all of the platforms filled," Lint said. "It is, after all, a case where man is picking a nest site for a bird. I think if we hit 50 percent we'll be doing well."

Added Witt, "This first year, we've only had two of the sites active, one with late season nesting. But next year, I think we'll see more being used. The year after that, maybe 50 percent used, and so on."

The platforms are constructed from western redcedar 2X4s and are bolted



Osprey nesting platforms are being used to fill in the habitat "gaps" along the Umpqua River in western Oregon.

and wired into place. BLM contracted for the topping of the towering trees and installation of part of the platforms.

If all goes as planned, the ospreys will nest and reproduce and wildlife biologists will spend more time counting fledglings through spotting telescopes in the next few years.

"If I were an osprey," said Lint, looking over the forested hillsides and deep running waters of the Umpqua, "this is the place where I'd settle."

Snags are important for many bird species other than the osprey. They're vital, in fact, to birds that make their homes in the hollowed-out portions of the trees. Woodpeckers, nuthatches, chickadees and other cavity dwellers all call snags home. In the Roseburg District, cull trees at the rate of two per acre on one test site were topped by an explosive device at the fifty-foot level to provide the cavity dwellers with customized homes. The process, said Lint, could be called "create-a-snag," and is the brainchild of Wayne Turner, timber manager in the South Umpqua Resource Area.

It's not a case of blasting the tree one day and having wildlife move into it the next. "It may be 20 or 30 years, but the culls we top today will be future nesting trees in the new unit," Lint said.

Safety risks prevent leaving existing snags in clearcuts. Snags tend to topple over easily during logging, and leaving them in the wrong parts of a cut area makes flying helicopters risky.

Blasting the tops off cull trees is safer than sawing them off, according to Lint.

Contractors climb the culls and place stump powder inside notches. Blasting caps and powder are detonated when a plunger is pushed 300 or 400 feet away.

"Blasting the tops off cull trees is another tool the timber manager and wildlife biologist have in their bag of tricks to provide cavity dwellers habitat," Lint said.

Nesting boxes, osprey high rises, and create-a-snag—together, they don't yet form a clear picture of a solution to the problems besetting wildlife habitat. But they're a start. Perhaps someday, through the innovative work of Lint, Witt, Turner and others, the puzzle pieces will all fit just right.

Natures F

By Joette Storm



A spray of pale corydalis atop a knoll in the Bear Creek Burn. 1980

Joette Storm is a Public Information Specialist for BLM in Anchorage, Alaska.

The helicopter is packed full with equipment and supplies as it lifts off the helipad, climbs with the morning sun out over Cook Inlet, and clatters westward, away from Anchorage. Wedged in among the duffle bags and scientific instruments, I struggle to make any move. Like a giant moth I am encased in an orange, cocoon-like, fire retardant suit, and the lack of space adds to my discomfort. Even so, I can hardly contain my excitement on this return trip to Farewell, Alaska, the site of the 1977 Bear Creek fire which burned more than 360,000 acres.

Touched off by lightning in early August, the Bear Creek fire exploded a few days later, sending huge mushroom clouds of smoke high above the mountains of the Alaska Range in Alaska's interior. It burned with the fury that kept hundreds of firefighters on the move as it grew to be one of the largest fires in the nation during a very dry year. The following spring I caught a glimpse of Bear Creek when it was ablaze with a different kind of color—fireweed, one of the first plants to grow and blossom after a fire. In the low lying areas the terrain was the emerald green of fairy tales.

As public information specialist for the Bureau of Land Management (BLM), I observed a special team of resource advisors at work during the fire. They had been assigned to assist the fire boss develop strategy for fighting the blaze and protecting the land's resources. The team, consisting of biologists, a forester, an archaeologist, and a soil scientist, assessed the plant and animal communities as well as the cultural and historic resources, and tried to gauge how the fire would affect them. Their observations would contribute to a growing

Forces Work Their Magic

body of knowledge on fire behavior and effects in the North.

The fire was a real learning experience for me. It was my first opportunity to observe how a suppression team functions and to view fire behavior first hand. Base camp bristled with excitement as fire crews and supplies were shuttled to and from spike camps along the fire's perimeter. The haste and noise contrasted with the calm, steady labor of the Native crews that worked on the edge of the fire, clearing brush and beating down flames with spruce boughs.

When heavy smoke isolated the fire and nearby community of McGrath, I became the link between the fire team and the news media. Looking for story ideas, I interviewed local game biologist Peter Shepherd for predictions on the fire's impact.

"In an area where rural residents often follow a subsistence lifestyle, living off the land, the loss of small game can be critical," he said. He feared that valuable habitat impact for furbearers such as marten was being destroyed by the fire. That would mean dire economic consequences for the local trappers.

Now three years later, as the morning sun begins to uncover traces of gold in the forest below, I rouse from my reverie with the realization that another summer is ending and autumn is just one cool evening away. My attention is turned to my companions for this trip, Kevin Meyer, soil scientist with BLM's Anchorage District, and Garlen Edwards, our pilot. Meyer, who is serving as navigator, has been involved in the postfire studies at Bear Creek for three years. He has flown this route many times and can aid Edwards in following the tricky series of turns through Rainy Pass en route to the Federal Aviation Administration station at Farewell. The tiny historic outpost served as base camp during the fire and now is headquarters for the studies.

Situated on the broad river plain, Farewell is a mere cluster of buildings



Vegetative cover is monitored and recorded in one of numerous test plots on the Bear Creek burn.

beside an airstrip. No one is in sight to greet us as Garlen sidles the chopper into place on the runway. We unload the gear and move it to one of the small frame buildings which make up the complex. Amid the jumble of boxes, field notes, and sample bags, we wait for Bill Hanson and his assistant Kate Engle to return. Their all-terrain-vehicle soon comes wheeling up to an abrupt stop.

The Bear Creek burn was chosen for the postfire studies for a number of reasons. It offered unusual opportunities to learn about wild fire in an area where the exact fire history was known. A resource team had made on-the-spot evaluations and recorded them during the fire and immediately after. Plant specialists were especially interested in the fact that fire burned many types of vegetation and at different severities leaving a wide range of effects in a relatively small area. Over time it is hoped the regrowth throughout the

burn can be compared with regrowth on similar adjacent areas that had burned during successive earlier fires in order to better predict how fire can best be used to enhance habitat for a wide variety of wildlife.

Hanson, a fire ecologist, is a member of the core team that initiated the Bear Creek studies and continued them during the past four years. Other team members are: Mike Hinkes, a wildlife biologist; Lou Waller, manager of BLM's McGrath Area; and John Beck, archaeologist. Dozens of specialists for other State and Federal agencies have contributed their skills for the study. Key support also has come from the USDA Forest Service Institute of Northern Forestry, whose plant and forest scientists—Les A. Viereck, John Zasada, and Rod Norum—helped design the Bear Creek study.

Hanson is eager to use the helicopter to check as many vegetation plots as he can in these last days of the



Close up of pale corydalis. This flower blooms after catastrophic events such as wildfire or volcanic eruptions, possibly due to the heat which releases seeds.



Burned trees the spring after the fire.

Bison feeding east of the South Fork. The fire seems to have increased feeding opportunities for the animals.



field season. After a quick cup of tea and some conversation about accommodations, he and Meyer are off. Kate Engle and I follow on a second shuttle a few minutes later.

The terrain is flat and monotonous, with its cover of tussocks and brush. Edwards is reluctant to land in the knobby tussocks, so he hovers while we scramble out onto the wet tundra. I need a moment to adjust to the spongy surface and wetness that begins to saturate my boots despite the water proofing.

Meyer is already at work digging a soil pit in a low spot that burned in 1972, but not in 1977. The heavy soil he encounters does not surprise him. He points to the mountains to the east and explains that the broad flat plain between the Alaska Range and the low hills some miles away is one huge glacial outwash plain. He returns to his digging, laboriously chipping through the frozen soil to determine the type of soil, its temperature, and the permafrost depth. While he probes the earth, I probe his mind for a lesson in soil science. A graduate of the University of Wisconsin, Meyer has spent a large part of his tenure with BLM inventorying the soils within the agency's 40-million-acre Anchorage District. He has begun to develop a profile of the earth's shell in this part of the world.

Amid the muskeg, mounds of dry earth protrude here and there, sporting collections of grasses. Meyer explains that the mounds are caused by ice lenses, which push the soils up as they expand during the winter. "The continual upheaval makes it difficult for some plants to establish themselves," he says, "so they have less vegetation than the surrounding wet areas." Because the mounds are drier than surrounding areas, they burn more severely. Plants growing on them cannot survive fire as well as those on adjacent moist areas.

In response to my questions, he digs into one of the frost heaves to show its structure. He notes that the heavy silt has acted as a seal, keeping the moisture much further below the surface than at the first site. Picking up a "ped," or chunk of soil, he studies it. The soil structure and the way the soil holds moisture have great effect on the types of vegetation the soil will support.

"We had a pretty good idea about what the conditions are here, but until recently, no one has recorded

observations to substantiate our theories. What we observe now can be applied to other similar areas in major portions of interior Alaska," he says. "If we know the soil types and climatic conditions, we can begin to make predictions or inferences about which plants will reestablish themselves after fire."

A major goal of the Bear Creek study is to document the changes that take place in the plant communities following fire and their use by wildlife. As I examine the plots and mentally review the stages of succession, I try to identify the plants and where they fit into the successional change brought about by fire. Hanson and Engle are doing the same. At each of the 16 subplots, Bill lays out a rectangular wooden frame and estimates the number of each species and the space they occupy.

At this stage of regrowth, mosses, cotton grass, dwarf birch, Labrador tea, and willows are abundant. Yarrow, blueberry bushes, and mushrooms are also present. Hanson notes the kind of seedbed, such as charred wood, unburned litter, or mineral soil.

"Most of the species that are going to become dominant are probably already present," he says. "Many plants survived because the fire did not burn deeply enough to kill their roots. Others have already reestablished themselves by wind-blown seeds. A few, such as spruce, may take much longer to reestablish because their seed sources are now far away. Even if a tree does become established, fires may reburn the area before the tree matures."

"Here at Bear Creek the area burns and reburns often enough to maintain low shrub plant communities even in those areas which could support a forest were it not for fire," says Hanson. The result is the addition of important wildlife habitat to western interior Alaska.

While they continue to read plots, I cut sections of trees so Hanson can determine their age. There is not much sign of animal life, only the millions of mosquitoes and flies, which buzz around me, impervious to the repellent I have so faithfully applied. Earlier in the summer, the area was alive with birds, says Engle, who spent several months estimating bird populations and trapping small mammals to record which ones have returned.



BLM wildlife biologists Les Vierck, Bill Hansen, center, and Dennis Money examine regrowth of vegetation during the 1979 field season.

The fire has had a significant impact upon many small birds and mammals. Bird species such as the white-crowned, tree and savanna sparrows are the most abundant species on the burned area. Other species, such as the boreal chickadee, Swainson's thrush, blackpoll, and orange-crowned warblers, can be found only on unburned areas. Bird numbers usually are higher in unburned than in burned habitats.

"Trees left standing on burned areas can make the difference in the number of birds reestablishing", says Mike Hinkes, BLM wildlife biologist. "They are an important part of the habitat and provide perches for singing and attracting mates."

For Hinkes, one of the best aspects of the Bear Creek fire was that it burned so many different types of habitat, creating a living laboratory for a diversity of studies on large mammals and small critters alike.

Redback voles are making a big comeback in the area of the 1972 burn, but are still below those levels in the unburned areas, according to Hinkes. By contrast, he had told me, the red squirrel is still found only in the unburned white spruce stands.

Like many biologists, Hinkes is fascinated with the large mammals. He has made some interesting observations about moose, bison, and black bear, which returned to the area quickly after the fire.

"Before the 1977 fire, grazing was concentrated around lakes and in dry lake beds and bogs. After the fire, grasses colonized and spread on the glacial moraines and other well-drained sites," he notes.

During the winter, Hanson and Hinkes have observed bison up to six miles inside the 1977 burn, farther away from the river than they have been seen in at least 10 years.

Increased availability of grass has

allowed the bison to expand their winter range. Although data on herd size is still incomplete, Hinkes observes a high rate of reproduction among the bison as well as a low mortality.

Today a surprise lies in store for us on the hilltop—a lovely spray of yellow and pink flowers which look like tiny lady slippers. Hanson calls them pale corydalis. He says they occur only after a disturbance such as fire and their origin is something of a mystery. "It may be that the seeds are buried deep in the soil and are germinated by heat of the fire," he theorizes. "Or perhaps once the other plants are burned, the seeds are finally exposed to light. Water, nutrients, and sunlight are all made more available by fire. That is why we view fire as a positive force in the environment."

Early in the study there were other pleasant surprises. When trees and plants are burned, the newly bared soil has nothing to hold it in place during rains and windstorms. The team, expecting the worst, looked for evidence that salmon-spawning streams had been clouded with silt washed from burned areas. They also measured the temperature they feared might have increased when insulating forests had burned away. They found that the fish habitat was virtually unharmed by the fire. Hanson says this is probably because stringers of trees growing along the river banks did not burn, and remained to protect the waters. Logs in the water have created new habitat for grayling and Dolly Varden trout, instead of blocking salmon migration as was feared.

Late that evening as he is identifying some new plant specimens, I ask Hanson if he has begun to draw some conclusions from his work, and if the study is accomplishing BLM's

objectives.

"I have spent so much time out here during the last three summers, I form new impressions every day," he replies. "I have a picture in my mind of what the area looked like last year and the year before and I can make some correlations as I go along."

Poring over field notes and data from previous seasons, he verifies those impressions, hoping to pattern the rebirth of the taiga, as the northern boreal forest is called. Once it is known, the pattern will help guide BLM's fire policy. For more than 30 years the agency has worked to develop sophisticated firefighting techniques, but today BLM is making the transition from a fire suppression agency to one that practices fire management. Based on studies such as the ones at Bear Creek, BLM's policy is recognizing that fire has an integral role in the natural environment in Alaska and that fire can be used as a land management tool to increase and sustain certain types of wildlife.

This is not a revolutionary idea, Hanson reminds me. The Indians of the Canadian grasslands knew that fire could benefit them because it created the conditions necessary for supporting the game they hunted. By allowing fires to burn in the spring, when there was moisture in the surface and snow on the forest floor, they were able to maintain feeding grounds for grazing animals.

"As we increase our knowledge and understanding of fire behavior and the way it affects plant and animal communities, BLM will perfect its ability to use fire as a management tool," he predicts. "Far from always being the destructive force it is perceived to be, fire often is a regenerating force, the catalyst for renewed life, in the taiga."

Decisions will be made by teams of resource advisors such as the one that BLM assigned to the Bear Creek fire. Specialists from a number of agencies in Alaska have been trained to work on such teams. "They will have a big job analyzing all factors," says Hanson.

BLM and other land management specialists will use the knowledge from fire studies in making on-the-scene decisions about the role of fire. It is interesting work, gauging nature's forces and allowing them to work their magic on the earth to create an ever-changing landscape.

Colorado Fuelwood Harvest- A Family Affair

By Evaline A. Olson

A permit from BLM and a family outing for a day can produce wood to keep the home fires burning.



In 1981, a forest fire raged across Poverty Mountain in Colorado. In its wake lay the charred remains of several hundred acres of mixed pinyon pine and juniper (P-J). Coloradans in southeastern Colorado saw the opportunity to economize by burning wood in fireplaces and stoves, thereby reducing home heating costs. The Bureau of Land Management (BLM) offered fire-killed trees in the Poverty Mountain burn area for sale to family firewood gatherers. Those who went in spit-and-polish clean came out loaded with wood but showing only the whites of their eyes and gleaming white teeth smiling through charcoal-caked faces. There were other areas of clean green wood available for families to cut and burn, but the charred wood was fully dried, burned exceptionally well, and was the choice of many woodcutters.

Jack Albright, Royal Gorge Resource Area Manager, in talking about the family wood gathering program in Colorado said, "The public is doing a fantastic job salvaging wood. This helps in the management of BLM's forested areas."

For BLM there's a very important aspect to the family wood gathering program. The P-J stands that make up much of BLM's wood products in Colorado develop a canopy or sun shade that deters growth of grasses for range and wildlife habitat, thereby interfering with that aspect of management. By setting aside family cutting areas and defining those trees that may be cut, the public, in effect, participates in management that improves both range and wildlife habitat.

The presence of families in the woodcutting areas doesn't seem to interfere with other uses of the land. As an example, in one woodcutting area there is active grazing use. On a given Sunday as families were gathering wood, a BLM employee noted that cattle and kids, chain saws and choppers were all going about their own activities without interference. Wildlife disturbance has generally been found to be temporary.

There's more to wood gathering than just the economic side, important as that is to both BLM and the wood gatherers. Mark Ashton, Colorado BLM forester, sees family wood cutting ventures as being part of the kindling that fires family unity. He said, "You can't determine the values of firewood harvest by only figuring

the cost of wood removed any more than you can determine the value of a fishing expedition by figuring the cost per pound of fish caught." In other words, there are often great social values to the family on an outing in search of firewood to blaze in the hearth.

There are also established commercial woodcutting areas. This year there will be several small clear cutting areas for commercial firewood harvesters. During fiscal year 1982, Albright reported the sale of 878 cords of firewood to 41 commercial operators in the Royal Gorge Resource Area. In addition, 4,477 cords were sold from family woodcutting areas under 1,685 permits. A cord of wood measures 4' high, 4' wide, and 8' long, or about two half-ton pickup truck loads.

An orbiting satellite (Landsat) has been used to inventory pinyon-juniper in Colorado's Canon City District, the first district in the Bureau to use this procedure. Such an inventory technique is important because of its economy and suitability for non-commercial forest management.

The satellite project is unique and clearly represents the state-of-the-art technology. Data recorded on magnetic tape obtained by the Landsat satellite, orbiting 570 miles above the earth, is put into a computer where each digital unit represents a ground cell approximately one acre in size.

Land ownership maps are "digitized" or transformed to numbers representing points on the maps and then are fed into the computer. Land ownership data combined with the Landsat information constitutes an inventory of the woodlands. Digital data available from the U.S. Geological Survey also is merged with this data base to provide elevation and slope information for each land cell unit.

The Landsat data cells are separated into pinyon-juniper and non-pinyon-juniper geographic units. The breakdown also establishes three classes of crown closure. Pinyon-juniper stands with greater than 39 percent crown closure and which occurred on slopes less than 35 percent are considered available for wood product harvesting and management under the principles of sustained yield.

When the project is complete, virtually all pinyon-juniper lands in BLM's Canon City District of Colo-



This burned forest does not necessarily mean unusable forest. The charred wood, fully dried, will burn well for home fires.

rado will have been identified and maps will be available for each resource area showing the three crown-closure classes. Another map will display individual townships showing the three crown-closure classes for those townships having more than 40 acres of operable land, along with tabular summaries of operable acres by township, forest management areas, wilderness study areas, resource areas, and total.

When the inventory is completed, all or parts of seven counties in Colorado will have been inventoried using this technology. Inventory data then will be used to regulate harvest of the pinyon-juniper forest for a sustained yield of woodland products.

During fiscal year 1983, two student conservation forestry aides are working with the range conservation and wildlife biologists in the field as the Landsat inventory progresses. They go directly to specific areas to confirm the computer data. They also will record woodland data as it relates to livestock, range, and wildlife habitat management. The range conservationists and wildlife biologists are counting heavily on the volunteer forestry aides to help them meet program commitments and to achieve sustained yield through

harvest that will thin the canopy and allow desirable vegetation to grow.

To enhance the overall effectiveness of the forest management program, an extensive cross-training of range conservationists and foresters is taking place throughout offices in Colorado. The end results will benefit both livestock grazing capability and wildlife habitat.

Interagency coordination has been productive as the Colorado State Forest Service and United States Forest Service work with BLM. Joint programs are designed with population centers and user groups in mind and reflect local conditions that exist within each area. Managing forest products, range, and wildlife habitat all go hand in hand, and how this program is managed can be mutually beneficial to all resources.

The woodland forest available to Coloradans has become an important economic factor, and the public appreciation BLM enjoys has been earned through a spirit of good neighborliness.

Evaline Olson is a Public Information Specialist for BLM in Denver, Colorado.

WHITE WATER THRILLS

By Mary Plumb

Southeast Utah has been described as the river running capital of the West, which presents an array of challenges and opportunities for BLM's Moab District. The Colorado River, kingpin of North American rivers, flows into southeast Utah and is joined there by its tributaries: The Green, the Dolores, and the San Juan. Thousands of people have used this public resource for access to BLM administered lands since a permit system began in 1973. BLM rangers have literally saved lives and beaches, as they rescued ill-fated parties in the rapids and cleaned campsites after users left. The boy pulled from death's edge in Westwater Canyon will never forget the public servant wearing a BLM uniform. And, with any luck, the foreign tourists who travel the U.S. will never suspect they weren't the first campers on the San Juan or the Green.

Over 19,000 people came to southeast Utah to "run the river" last year. In an area where the largest town can only boast a population of 8,000, the economic implications are obvious. Perhaps too obvious. River running is the kind of resource where nature and the "here and now" reign. When confronting an eight-foot wave that has killed an experienced boatman, profit margin and overhead are usually forgotten. Even on the stretches where it's more fun than life threatening, it's easy to forget that river running means business, and commands respect as an important facet in a diversified economy for southeast Utah.

Commercial outfitters have

invested millions of dollars and many years in their industry. It's rumored that a pioneer river running company in Moab changed hands this year to the tune of \$1.5 million. The BLM Moab District works with 29 commercial outfitters and all are doing what they can to bring as many tourists as possible to southeast Utah.

BLM is quick to thank the business for their cooperation in keeping the resource clean. Professional boatmen are also pros at river-etiquette. Firepans leave no charred scars and in many cases not even a pop-top or cigarette butt greets following fun-seekers. They do it because they care.

Euphoric eulogies epitomize the river rat, perhaps best captured by naturalist Ann Zwinger in her famous book *Run, River, Run*. In describing her experiences on the Green River she says, "to the east a full moon rises, etched with the black lines of an unleaved willow bush. The river runs mauve, reflecting the pink and gray and lavender of the cliffs in amorphous swirls of color. Tree

branches darken to silhouette. The inside leaves of the cottonwoods hang still; only the very outer ones quaver in the evening drafts. Colors seep out of the river, the cliff, the sky, leaving only lambent river . . ."

As river running has become the thing to do, more and more river rats seek to improve their skills as private boaters, rather than being catered to by a guide. River rats come from all walks of life to seek the kind of experience that Ann Zwinger best describes. This growing demand for a chance at a thrilling adventure or wilderness float is keeping BLM busy.

With over 300 miles to manage, each canyon presents different challenges to serve the public. Each is a floating lesson in geology, history and wildlife, and has a different personality worth saving for tomorrow's grandchildren. This challenge is met by BLM based on what the public wants and the unique character of each canyon.

Starting in the northern part of the Moab District, the Green River offers



two distinctly different dimensions in Desolation-Gray Canyon or in Labyrinth Canyon. BLM manages an 84-mile stretch through Desolation-Gray Canyons which offers a week-long wilderness experience rich in cowboy and outlaw lore and 1000-year-old Fremont Indian petroglyphs. The canyons have been designated a National Historic Landmark in reverence to John Wesley Powell's first trip to 1869. He wrote, "After dinner we pass through a region of the wildest desolation. The canyon is very tortuous, the river very rapid, and many lateral canyons enter on either side. These usually have their branches, so that the region is cut into a wilderness of gray and brown cliffs."

Spectacular Labyrinth Canyon, downriver from Desolation-Gray, offers unique recreational values quite different from other river canyons in the region. It is entirely flat water and is an excellent canoe stretch. It is also the site of an annual promotion called the "Friendship Cruise," which brings an economic spurt to the town of Green River.

On the Colorado River, Westwater Canyon has been popularized by nearby urbanites seeking a one day thrill of heart-pounding white water. It could be described as a mini Grand Canyon, due to the ancient black schist that also appears in the Grand's inner gorge. The canyon contains the most treacherous rapids in the Moab District, embellished with titles such as "Funnel Falls" and "Sock It To Me."

The Dolores River is a spectacular

trip about 31 miles in length and provides several challenging rapids. One of the more challenging is State Line Rapid. In high water it is probably the most dangerous rapid in the Moab District. Dependent on spring runoff, the Dolores River has the District's shortest season, usually being runnable only during the last two weeks in May and the first two weeks in June.

The San Juan River also has a shorter season than the others, except when runoff from summer thunderstorms rapidly raises the river and produces roller coaster sand waves. It is the richest river stretch containing ancient Anasazi Indian ruins and rock art. The San Juan provides public access to an area extensively occupied by the Anasazi culture from before 500 A.D. to 1270 A.D. The Grand Gulch Primitive Area is one of several side canyon hikes available to explore.

It is an area rich in antiquities. Surveyed areas have recorded archaeological site densities of up to 200 per square mile. Many appear just as first discovered. Numerous artifacts have been illegally removed from the area since the 1890's but an enormous amount of material remains for scientific study. BLM rangers try to instill the outdoor museum concept to river users: enjoy and learn from the resource but leave it as you found it.

River running is also becoming popular on the Muddy and San Rafael Rivers, when spring provides access to these two scenic canyons.

BLM management requires permits for Desolation-Gray, Westwater, and

the San Juan, but because each canyon offers varying uses by the public, each has a different permit system. For Desolation-Gray, a drawing is held in mid-March to fill high-use periods on weekends, holidays, and during the first week in June. Any remaining dates are filled on a first come, first served basis. To preserve the wilderness experience, permits are limited to one 25-person party per day. The Westwater permit system is responsive to both those seeking a wilderness experience and also to those seeking a quick white water trip. Permits are drawn one month in advance to fill competitive dates with a 35-person limit Sunday through Thursday and a 75-person limit on Friday and Saturday. After the initial drawing, permits can be obtained on a first come first served basis until the daily limit is reached. On the San Juan, permit applications are accepted after January 1st and trip dates are issued on a first come, first served basis.

Unblemished since 1973, BLM's river management record suffered three fatalities during the 1982 season. Labyrinth Canyon's flat water claimed one life, and Westwater Canyon claimed two—one an experienced, professional boatman. The BLM river rangers have been involved in many rescues which could have resulted in fatalities, as documented in incident reports.

BLM river rangers man the put-in points on Desolation-Gray, Westwater, and the San Juan, and serve as the heartbeat of the river management effort.

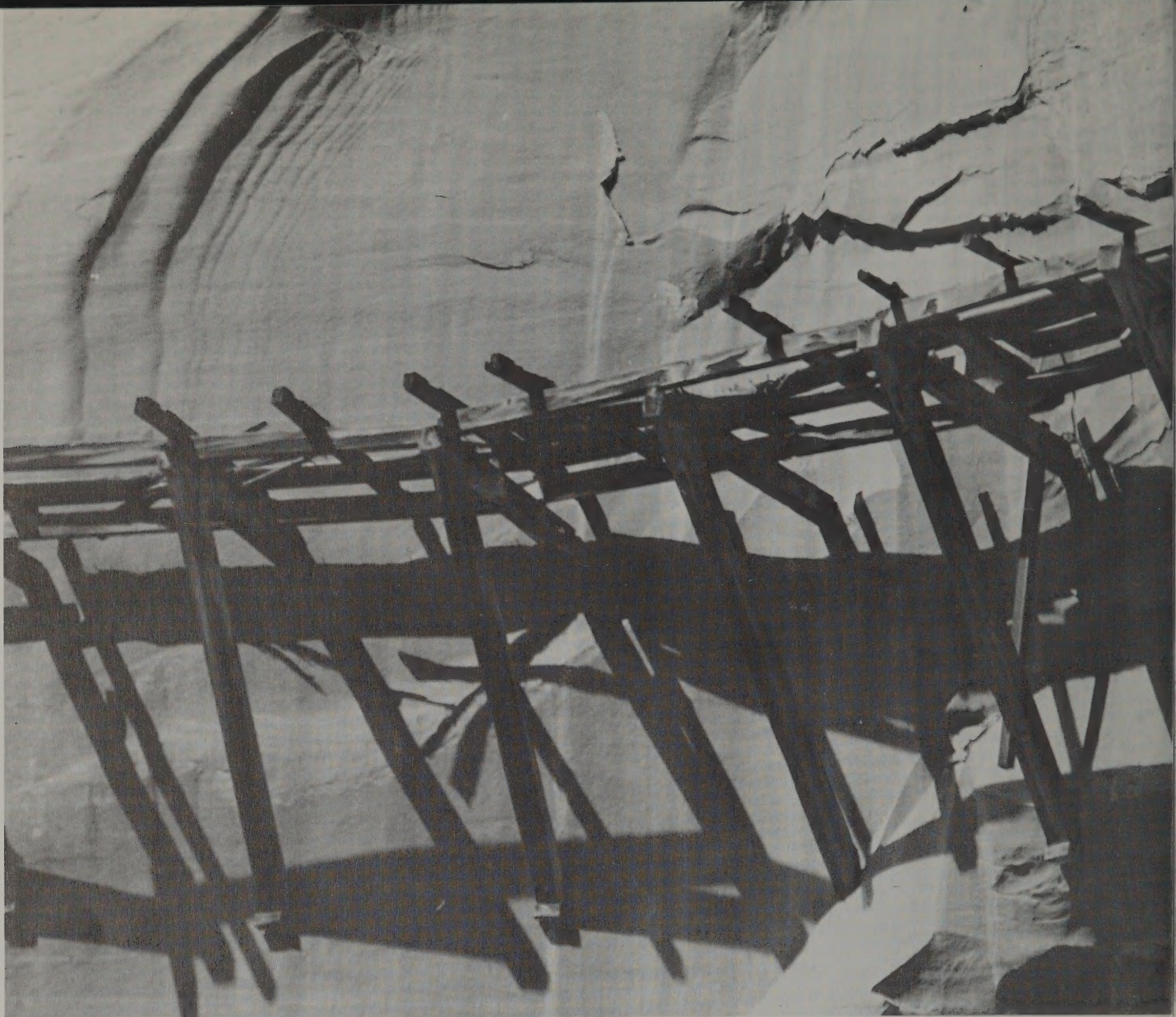
The Moab District river management program has protected important public resources, prevented the loss of lives, and it provides the foundation to an integral economic base in southeast Utah. You're invited to share a morning's coffee on the river of your choice. It really cannot be beat!

Inquiries about boating in southeast Utah should be directed to the Moab District, Bureau of Land Management, 125 W. 2nd S. Main, P.O. Box 970, Moab, Utah 84532.



A commercial boatman "runs the hole" in Skull Rapid, Westwater's most notorious. (This shot was taken at low water, at high water the wave gets much bigger.)

Mary Plumb is a Public Information Specialist in BLM's Moab District, Utah Office.



The Hanging Flume of the Dolores

A Unique Engineering Accomplishment

By Douglas D. Scott

Since 1859, gold has lured men to the mountains and streams of Colorado. The desire to find and recover gold in the mountainous regions of Colorado has required miners to employ new, and often ingenious, methods to extract this precious resource. In 1887, the Montrose

Placer Mining Company bought six and one-half miles of placer gold mining claims on the Dolores River in west-central Colorado, an event which triggered the construction of a unique engineering feature—the hanging flume of the Dolores.

The placer miners prospected the Montrose claims in the fall of 1887 and during the spring of 1888. Their panning yielded a good show of gold, but it became obvious that traditional methods of extraction would not be profitable. The superintendent,

N.P. Turner, along with several other individuals concluded that, if enough water could be brought to the Mesa Creek Flats claims area, hydraulic mining procedures could be effectively and profitably employed. The Dolores River had more than an adequate water supply.

The problem was how to get enough pressure and water to Mesa Creek through the winding, precipitous, deeply entrenched Dolores River Canyon that had only limited access. To Superintendent Turner the answer



The bracing system of the flume is supported by hand-cut rock notches and blacksmithed bolts driven into the sandstone face of the Dolores Canyon walls.

was simple enough; build a ditch and flume system along the Dolores to Mesa Creek and then extract the millions in placer gold that awaited the innovative entrepreneur.

And construct a flume they did! The remnants of the hanging flume still cling to the walls of the Dolores River Canyon and they are considered such a significant engineering feat that the hanging flume was placed on the National Register of Historical Places in 1980.

According to the Engineering and Mining Journal of May 17, 1890, the flume was begun in 1889 and constructed in the following manner: "There is about half and half ditch-

ing and fluming, and the latter has a fair claim to be considered a fine piece of engineering work, the flume being suspended on brackets and on benches. The total costs will be about \$75,000 when finished, and it is expected to be completed within a few months. This work was commenced at the lower end, where the greater part of the flume is. This was done for the reason that the forest from which the lumber was obtained is located nearest that point. Now work is going on at the upper end where the river is tapped, floating the lumber down the flume to where it is required. By this means it is hoped to have everything tight and no leakages to give trouble when hydraulicking is commenced. This work will show how easy it is, when backed up by enterprising capital, to bring water from and to points which were always thought to be inaccessible."

"The flume traverses the whole length of the Dolores Canyon which is almost four miles. It is fastened to the walls of the cliff, and

for a long distance is at an elevation above the river of 300 to 400 feet. It is very firmly built and has been fully tested to carry the volume of water which will pass through it when finished."

"At a number of places the lumber has been piled in the flume as high as 13 feet and additional weight added to it without any noticeable variation. A large rock weighing many tons fell from the top of the cliff and only tore off a small section of 20 feet. It snapped off the heavy timbers as if they were matches, without loosening or even straining the supports a few feet further on. The break was entirely and fully repaired in two hours. The lumber is clear mountain pine, the wide boards and dimension pieces running full length, without sap and with very few knots. It is all well seasoned before being used."

"In getting the levels the work was very dangerous, the man being lowered down over the cliff over 50 feet, marking in red paint the line to be followed by the construction gang. As the supporting

The highway interpretive sign was erected by BLM, the Colorado Historical Society, and the Colorado Highway Department. The sign contributes to the building of local legend since it was erected before significant research on the flume had been completed.





Aerial view of the flume

timbers were put in place, the floor of the flume was laid and the derrick pushed out ahead, from which other supporting timbers were raised and secured to their places. Under favorable conditions and with a gang of 12 men, 250 feet per day have been erected. At one point on the line, nearly 200 feet long, the rock projects out, forming a sort of canopy, and is so shaped that it was impossible to support the flume on brackets, and it is hung from bolts, driven in overhead, on which the flume swings."

"In making the survey for this work the nature of the country necessarily made it a very difficult operation, as most of it had to be done by triangulation. It is very creditable to be able to state that no mistakes were made except slight ones, which were easily corrected. The flume is fastened to the cliff . . . The bolt is 1-1/4 inch in diameter, and is driven in the rock 18 inches, the shoulder which

supports the weight being first bent to shape at the blacksmith shop. The long brace at the bottom rests on a shelf—natural, if it can be found, otherwise one is cut, and the pin is driven through this brace into the rock, and thus prevents it getting loose."

Wilson Rockwell, author of *Uncompahgre Country*, obtained additional information of the construction and use of the flume system from local residents. According to Rockwell, the mining company established a sawmill in San Juan County, Utah, to cut timber for the flume. The lumber was hauled by six-horse-hitch wagons to the building site along the Dolores. Most of the lumber was two-inch pine boards. Approximately 1.8 million board feet of timber were used in the construction of the four-foot-deep, six-foot-wide, three-sided flume.

The flume was supported by brackets on the cliff walls high above the river and from 250 to 500 feet below the summit of the gorge.

In building the flume bed along the side of the cliffs, an improvised flat car was used with a long crane attached to the front of it. This car was pushed on improvised railroad tracks along the flume bed, and the crane in front was used to hold the workmen out over the canyon wall while they drilled holes into the face of the wall to insert the iron brackets on which they would build the flume. When one joint was completed, the tracks on the flume bed would be extended and the flat car with its platform pushed forward to construct the next joint. The rear of the car was loaded with rocks to weight it down while the crew was working out over the cliff on the crane. Where the bluff was straight enough with no overhanging walls, men were dropped over the side in "bosun" chairs to drill the holes, insert the braces, and lay the flume. One of the "bosun" chairs can still be seen in rockshelter on the Dolores River that served as one of the campsites for the laborers.

The lumber for the flume was pulled up from the bottom of the canyon with ropes, or lowered down from the top of the canyon, depending on which way was more feasible. In the deepest part of the canyon, where it was impossible to get a wagon and too far to swing the lumber over the top, the building

material was floated down the river on a barge and then pulled up by the ropes to where the men were working.

Local labor of about 25 individuals was used in the construction of the project. According to Wilson Rockwell the laborers were paid \$2.50 per day plus board. Legend has it that Chinese coolies were the primary labor source and that substantial numbers of them were killed during the undertaking. As with most legends, there is a grain of truth in it but only a grain. There was one Chinese on the project and he was the cook. There was also one man killed, the but he drowned while swimming in the river.

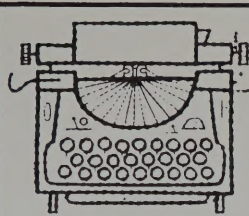
It took over two years and more than \$100,000 to complete the hanging flume. The project was completed during the summer of 1891 and on the day water was turned into the flume all the cowboys and miners in the area came to see the big event, or so the story goes.

From an engineering perspective the flume was a complete success. The flume carried 80 million gallons of water over a 24 hour period and fell in a grade of six feet, ten inches to the mile over an eight-mile length.

Unfortunately, the mining operation was not as successful. The placer gold in the river is an extremely fine flour gold and could not be extracted by hydraulic pressure. The gold washed right through the sluice boxes. Superintendent Turner thought the liberal use of quicksilver (mercury) as an amalgam was a cure, but even the quicksilver could not hold the gold. By the fall of 1891, the project was an obvious failure. According to legend, Turner, on a promotional trip to Chicago, killed himself over the failure.

The flume was shut down in 1891, the same year it was finished, and the local ranchers and farmers salvaged as much of the lumber as possible for use in constructing sheds, and other ranch out-buildings. The remaining portions of the abandoned flume began their slow decay, but some of the skeletal remnants of the enterprise still cling to the walls of the spectacular Dolores River Canyon for the modern passerby to see.

The Hanging Flume, located on BLM-administered public lands in southwest Colorado has been placed on the National Register of Historic Places.



News Highlights

Land Use Planning

More involvement by governors in land use planning for public lands is one of the highlights of the final BLM planning regulations. Amendments to the regs implementing the land use planning requirements of the Federal Land Policy and Management Act of 1976 will also result in substantial cost and time savings, primarily by reducing inventory levels to those needed to make sound decisions. The final rules were also revised in response to the more than 300 public comments received from State and local governments, industry, interest groups and private citizens on the draft proposal. One of the purposes of these amendments is to make the regulations simpler and easier for the public to understand. The full text of the final regulations was published in the May 5 Federal Register Notice and will become effective on July 5.

International Symposium on Wilderness Fire

University of Montana, Missoula
November 15-18, 1983

A symposium sponsored by the Intermountain Forest and Range Experiment Station, the National Wild-fire Coordinating Group, the Society of American

Foresters, and the University of Montana, will be held in November.

The symposium will consist of invited papers and contributed poster presentations summarizing current policy and programs in parks, wilderness, fire management issues such as what is "natural," relevance of of past Indian burning, role of lightning versus human ignitions, fire size and intensity considerations, visitor safety, air quality, and economic criteria. Planning considerations and operational techniques will be discussed along with park and wilderness fire case studies. A workshop aimed at resolving park and wilderness fire management issues will round out the program.

Contact: Center for Continuing Education, 125 Main Hall, University of Montana, Missoula, MT 59812, telephone (406) 243-2900.

Sanctuary Management

Agreement on the daily management of the California Islands Wildlife Sanctuary was signed May 24. Under the agreement, the lands will remain in Federal ownership, but the daily management will be in the hands of the State. The agreement covers thousands of small rocks, pinnacles and

islands as well as the birds and mammals that use them for nesting and resting. The islands and rocks provide critical habitat for seals, sea lions, and sea birds. The action will also ensure the continued and undisturbed use of the area as havens and stopping places for the California and stellar sea lions, harbor and other migrating fur seals, sea otters, and many different species of birds.

A withdrawal order to close the area to mining and mineral leasing, providing additional protection to the sanctuary, was recently signed by the Interior Assistant Secretary for Land and Water Resources.

Coal Team Results

Although the first offering of coal leases in the Fort Union Coal Region will not take place until later this year, the Fort Union Regional Coal Team decided on June 1 to proceed with initial steps toward a second-round offering possibly in September 1985. The team identified eight Montana tracts to be offered in 1985 and agreed to try a cooperative coal lease arrangement involving lands of BLM, the State of Montana and Meridian Land and Minerals (a subsidiary of Burlington Northern Railroad), creating a contiguous block of minable coal.

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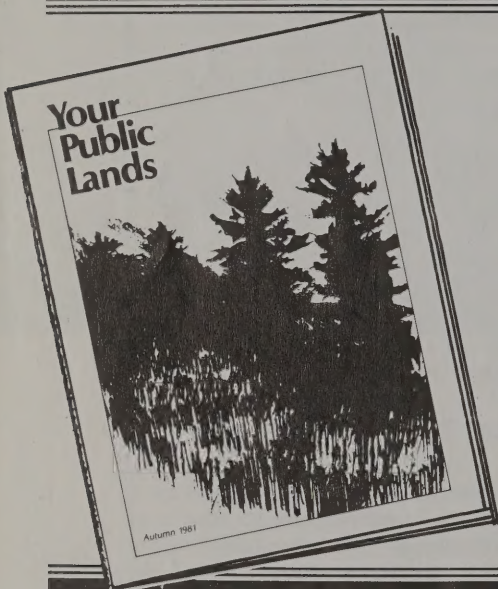
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